

# Compositional study of IIIrd century BC silver coins from Kreshpan hoard (Albania) using EDXRF spectrometry

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## Abstract

The elemental composition of 122 silver coins from a hoard of the 3rd century BC, minted by the Illyrian king Monounios and the ancient cities of Dyrrachion and Korçyra was determined by EDXRF. The results showed that the different groups of coins were made of a similar Ag–Cu alloy with Ag concentration in the range 94–98%. The examination of the contents of minor elements Pb, Au and Bi showed that the coins minted by the Illyrian king Monounios have similar composition with the largest part of Dyrrachion coins and those from Korçyra. On the other side, two subgroups containing different amounts of Au and Bi can be observed within the general group of coins minted in Dyrrachion.

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## 1. Introduction

The development of non-destructive physical methods of analysis has opened new windows for the study of archaeological objects. The data obtained by the application of these methods can help the archaeologists to answer specific questions concerning dating, technology, provenance and authenticity of the objects that the traditional methods cannot solve.

X-ray fluorescence is probably one of the earliest and most widely used methods for elemental analysis of ancient coins [1,2]. This is related with the characteristics of the

method like non-destructive nature, the possibility to analyze a great number of elements in a wide concentration range, fast analysis, good analytical parameters, etc. However, one must bear in mind that during totally non-destructive measurements of ancient metals (without any preparation of the sample) the accuracy of the results can be influenced by a number of factors like the existence of corrosion products, surface enrichment or depletion of some elements, etc. [1–3].

The Institute of Archaeology in Tirana has a big collection of different types of ancient coins which were found during excavations in the Albanian territory. The majority of the coins were minted by the two big centres of the Illyrian Adriatic coast Dyrrachion and Apollonia which were founded by Greek colonists, respectively, at the end of the 7th and the beginning of the 6th centuries BC.

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These cities have minted both bronze and silver coins which were used for both internal trade with Illyrian hinterland and foreign trade with the other big centres of the ancient world. The silver coins minted by these cities are also found in other Balkan and European countries and there are reports that some of them found in Romania and Hungary were studied by EDXRF and PIXE [4,5].

One of the most interesting groups of coins is the hoard discovered close to the village Kreshpan in central Albania (Fig. 1). The hoard contains 209 silver coins, which include staters and half staters with the pattern of suckling cow, minted by the Greek cities of Korkyra, Dyrrachion and

by the Illyrian king Monounios, together with quarter of staters with the pattern of Herakles minted in Dyrrachion (Fig. 2). The numismatic study of these coins, which include the determination of the weight and diameter, the evaluation of pattern characteristics and style, the monograms, inscriptions, etc. was published by Gjonecaj [6]. Some general characteristic are presented in Table 1. The most important findings of the hoard are 45 coins of the Illyrian king Monounios, which illuminate the historical period of the domination of this king in the Illyrian territory and also his relationships with the great centres of the ancient world in the vicinity of Illyria. The archaeological interest of these coins is extraordinary because only three coins of king Monounios were known before the discovery of this hoard. King Monounios' coins allowed dating of the hoard's burial around 270 BC. It is interesting to notice that king Monounios' staters show a stylistic evolution which should probably be related with the growth of his power. At the beginning, to the normal pattern of Dyrrachion stater ( $\Delta Y P$ ) few symbols of the king (a wild boar jawbone and a spear head) were added. Later, on most of the coins, we find the symbol of the city ( $\Delta Y P$ ) associated with the name of the king ( $BACIAE\Omega C$   $MONOYNIOY$ ) and finally there are some coins on which, we find only the king's name without the symbol of the city. There are strong indications from the numismatic study that during 280–270 BC the Dyrrachion mint was used for minting the staters of the Illyrian king Monounios.

During the last years a group of silver coins from the Kreshpan hoard was studied using different analytical methods like EDXRF, microhardness measurements, PIXE, optical and electron microscopy. The general objectives of this study were related with the determination of the chemical composition of the coins and the investigation of their manufacturing technology. EDXRF was selected for the determination of the chemical composition of the coins as the only non-destructive and non-invasive analytical technique available. Due to strict rules related with the administration of coins it was permitted neither to sample or clean the coins' surface nor to move a large number of



Fig. 1. Map of the central and southern part of Albania, where Dyrrachion, Apollonia, Korkyra and the village Kreshpan are noted.

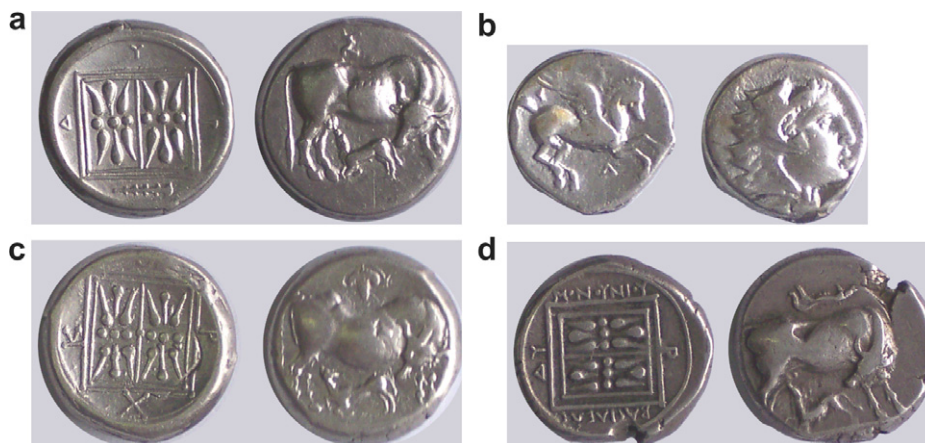


Fig. 2. Photos of representative coins from each group (a) Dyrrachion stater; (b) Dyrrachion quarter stater; (c) Korkyra stater; and (d) king Monounios stater.

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